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VARIAN ENGINEERING
REPORT NO. 132-10

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PROGRESS REPORT

REFINEMENT AND PRODUCTION OF 1000 RUGGED
X-BAND LOCAL OSCILLATOR V-52 KLYSTRONS

For Period: 1 April to 30 April 1953

Prepared for

Bureau of Ships Navy Department

on

BuShips Contract NObs-5358

Prepared by:

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David Clifford

Approved by:



H. Myrl Stearns
Vice-Pres. and Gen. Manager



Sigurd F. Varian
Vice-Pres. for Engineering

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PURPOSE

The purpose of the program engaged under BuShips Contract NObs-5358 is to refine and produce one thousand (1000) rugged X-band local oscillator V-52 klystrons. This tube is to comply with the specifications of SHIPS E-720, which were subsequently modified at a conference held at the Bureau of Ordnance, Washington, D.C. on 20-21 May 1952 and later at a conference held at Varian Associates on 29-30 September 1952.

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PROGRESS

Since it was apparent that tubes being manufactured in production were operating at a lower power level and with poorer temperature compensation than the prototypes, a number of steps were taken in an effort to improve this situation.

Several investigations were conducted. First, an attempt was made to correlate power output and glass coverage of mica window surfaces, but no correlation seemed to exist. Second, a number of tubes were assembled using drift tubes fabricated from Kovar. Third, another group of tubes was produced utilizing drift tube assemblies manufactured by the research and development group. Fourth, a small group of tubes was produced in which the loading slug associated with the output iris was made of copper-plated steel. None of these investigations produced any significant changes.

Toward the end of the month, it was decided to convert from the standard 0.0015-inch copper plating thickness used on all other tubes in production to the 0.0005-inch thickness employed in the prototype V-52 tubes. The necessary engineering orders to change operation schedules and to specify compensating part dimensions were initiated.

It should be noted that the Kovar drift tubes mentioned above operated substantially the same as the standard molybdenum drift tube. As soon as the power and drift requirements are brought under control, it is intended to investigate further the use of Kovar, since this material is much more readily handled and fabricated.

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In order to reduce cathode stem cracking in the rubber molding process, it was found necessary to increase the length on the cathode end of the finished tube. In addition, improvements were made in the molds so that pressures could be accurately controlled and glass cracking minimized.

Drawings and operation schedules were reviewed and brought up to date. Concurrently, parts and assembly handling techniques were modified to attain closer control over critical dimensions.

Considerable difficulty was encountered due to high loss in grid mounting operations. This was discovered to be in part a result of inadequate temperature regulation on a hydrogen furnace being used. Productionwise, however, the process still leaves much to be desired and improved techniques are to be investigated.

During the month of April, 37 tubes were assembled and pumped, of which 27 reached test. Average test values obtained are given in Table I.

TABLE I

Frequency (mc)	8800.00	9600.00
Beam voltage (v)	350.00	350.00
Beam current (ma)	52.89	52.65
Reflector voltage (v)	-132.85	-164.65
Power output (mw)	90.56	105.04
Bandwidth (mc)	70.12	40.12

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TABLE I (Continued)

Modulation sensitivity (mc/v)	2.02	1.51
* Ten-minute drift (mc)	---	-8.00

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* Approximate peak of distribution (not arithmetic average)

Three V-52 tubes (tubes No. 653, 673, and 738) were placed on life test this month. Tube No. 679, which was placed on life test in March, was still in operation at the end of April and will be maintained until failure.

During the month of April the special silastic rubber curing oven ordered from the Dispatch Oven Company, was delivered. This oven was set up and will be placed in operation as soon as the associated program controller is received. Delivery of the program controller is promised for early May.

Also ordered and received during the month was a small Thelco electric utility oven. This low temperature oven will be employed in conjunction with a special cavity mold for molding the silastic rubber end seals as an alternate to transfer molding using the preco press. The Thelco oven will be used until the optimum production method is determined.

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PROGRAM FOR NEXT INTERVAL

Additional tubes will be put on the pumps and tested during the next interval.

The study of the decline in tube performance from prototype to production models will continue. Production tubes will be very carefully compared with prototype models.

Further investigation into the grid mounting difficulties encountered this month will be made.

Attention will continue to be focused on assembly procedures which tend to lower production costs.

Life testing of tubes will continue.

Estimated expenditures during April 1953: \$23,300.00

Estimated man-hours during April 1953: 1160

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